WHAT IS CLAIMED IS:

1. A microfluidic device comprising:

a loop channel communicating with at least one service channel,

a microvalve separating the loop channel from the service channel,

a pump associated with the loop channel.

2. A device of claim 1, wherein the at least one service channel comprises at least one inlet and one outlet.

3. A device of claim 1, wherein the pump is a peristaltic pump.

4. A device of claim 2, wherein each inlet and outlet is separated from the loop channel by a microvalve, and wherein the pump comprises at least three cooperating microvalves acting within the loop channel.

5. A device of claim 1, further comprising a set of target molecules disposed within the loop channel.

6. A device of claim 1, wherein the pump comprises at least three cooperating microvalves acting within the loop channel, and further comprising a set of target molecules disposed within the loop channel.

7. A device of claim 5, wherein the target molecules are polynucleotide probes.

8. A device of claim 5, wherein the target molecules are protein probes.

9. A device of claim 5, wherein the target molecules are antibodies.

10. A device of claim 5, further comprising at least one detection region coincident with at least a portion of the loop channel.

11. A device of claim 6, further comprising at least one detection region coincident with at least a portion of the loop channel and at least one detector associated with at least one detection region.

12. A device of claim 1, wherein the loop channel resides in a layer of elastomeric material.

13. A device of claim 4, wherein the loop channel resides in a layer of elastomeric material, and the valves are formed from an elastomeric membrane.

14. A device of claim 6, wherein the loop channel resides in a layer of transparent elastomeric material and the valves are formed from an elastomeric membrane.

15. A device of claim 14, further comprising at least one detection region coincident with at least a portion of the loop channel.

16. A device of claim 12, wherein the elastomeric layer is adjacent to a substrate layer.

17. A device of claim 13, further comprising at least one detection region coincident with at least a portion of the loop channel, and wherein the elastomeric layer is adjacent to a transparent substrate layer.

18. A device of claim 14, wherein the elastomeric layer is adjacent to a transparent substrate layer.

19. A device of claim 1, wherein the loop and service channels reside in a treatment layer, and further comprising a control layer adjacent to the treatment layer and carrying control lines.

20. A device of claim 19, wherein the treatment and control layers are elastomeric.

21. A device of claim 20, wherein the treatment and control layers are bonded to each other.

22. A device of claim 21, wherein at least one of the treatment and control layers is transparent.

23. A device of claim 19, wherein the control lines comprise at least one channel which is carried by the control layer and which intersects at least one channel carried by the treatment layer.

24. A device of claim 23, wherein at least one intersection of channels forms a microvalve.

25. A device of claim 24, wherein the microvalve comprises a deformable membrane between a treatment channel and a control channel.

26. A device of claim 24, wherein the control channels are supplied with a pressurized fluid.

27. A device of claim 25, wherein the control channels are supplied with air.

28. A device of claim 27, further comprising a transparent substrate layer adjacent to at least one of the treatment and control layers, and wherein at least one of the treatment and control layers is also transparent.

29. A device of claim 25, further comprising a set of target molecules disposed within the loop channel and at least one detection region coincident with at least a portion of the loop channel.

30. A device of claim 29, wherein the loop channel is circular.

31. A microfluidic device comprising:

a treatment layer having elastomeric fluid channels comprising a loop channel, a loop inlet channel, and a loop outlet channel,

a control layer adjacent to the treatment layer and having elastomeric control channels, wherein at least one control channel intersects each of the inlet and outlet channels to form microvalves, and at least three control channels intersect the loop channel to form a peristaltic pump.

32. A device of claim 31, wherein the elastomeric material is transparent.

33. A device of claim 31, wherein target molecules are disposed in the loop channel.

34. A device of claim 33, wherein the target molecules are patterned on a surface of the loop channel.

35. A device of claim 34, wherein the patterned surface is a transparent substrate that seals at least a portion of the length of the loop channel.

36. A device of claim 31, wherein the control channels receive a pressurized gas.

37. A device of claim 36, wherein the loop channel receives fluid from the inlet channel.

38. A device of claim 37, wherein the fluid is an aqueous liquid and the pressurized gas is air.

39. A device of claim 38, wherein target molecules are in the loop channel, and further comprising at least one detection region coincident with at least a portion of the loop.

40. A device of claim 39, wherein the target molecules are patterned on a transparent substrate that seals at least a portion of the length of the loop channel.

41. A device of claim 40, wherein the pattern of target molecules coincides with a detection region examined by an optical detector.

42. A device of claim 41, wherein the target molecules are labeled with a reporter.

43. A device of claim 41, wherein the target molecules are labeled with a fluorescent reporter.

44. A device of claim 41, wherein target molecules are polynucleotdies.

45. A device of claim 41, wherein target molecules are polypeptides.

46. A device of claim 41, wherein target molecules are antibodies.

47. A device of claim 31, wherein the elastomer is a molded silicon elastomer.

48. A device of claim 31, wherein channels are formed by soft lithography.

49. A device of claim 31, further comprising at least one mixing channel in communication with a loop inlet channel.

50. A device of claim 49, wherein the mixing channel is on the treatment layer and has at least one microvalve provided by an intersecting control channel on the control layer.

51. A microfluidic device according to claim 1, wherein the loop channel comprises at least one pair of interconnected parallel and antiparallel channels.

52. A microfluidic device according to claim 51, wherein the loop channel comprises a plurality of pairs of interconnected parallel and anti-parallel channels.

53. A device according to claim 31 wherein the control lines comprise at least three parallel channels which are carried by the control layer, in which each of the at least three parallel channels intersects at least one channel carried by the treatment layer.

54. A microfluidic device according to claim 31 wherein the loop channel comprises at least one pari of interconnected parallel and antiparallel channels.

55. A microfluidic device according to claim 54 wherein the loop channel comprises a plurality of pairs of interconnected parallel and antiparallel channels.

56. A microfluidic device according to claim 31 wherein the at least three control channels are parallel channels.

57. A microfluidic device comprising:

a plurality of loop channels, each loop channel communicating with at least one service channel; and

a pump associated with each of the plurality of loop channels.

58. A microfluidic device according to claim 57 wherein the pump associated with a loop channel comprises at least three cooperating microvalves acting within the loop channel.

59. A microfluidic device according to claim 57 wherein a set of target molecules is disposed within each loop channel.

60. A microfluidic device comprising:

a treatment layer having elastomeric fluid channels comprising at least one inlet channel, at least one outlet channel, and a plurality of loop channels; and

a control layer adjacent to the treatment layer and having a plurality of parallel elastomeric control channels, wherein at least three control channels intersect each loop channel to form a peristaltic pump.

61. A microfluidic device according to claim 60 wherein a set of target molecules is disposed within each loop channel.

62. A microfluidic device according to claim 61 wherein the target molecules are patterned on a substrate that seals at least one portion of the length of each loop channel.

63. A microfluidic device according to claim 62, wherein

the substrate is a microtiter plate having microtiter wells, each microtiter well having a target molecule patterned thereon; and

the microtiter plate is connected to the treatment layer so that at least a portion of the length of each loop channel is sealed by a microtiter well.

64. A microfluidic device according to claim 63, wherein the microtiter plate comprises 96 microtiter wells.

65. A microfluidic device according to claim 63, wherein the microtiter plate comprises 384 microtiter wells.

66. A microfluidic device according to claim 63 wherein the microtiter plate comprises 1536 microtiter wells.

67. A microfluidic device according to claim 57 having 96 target loops.

68. A microfluidic device according to claim 57 having 384 target loops.

69. A microfluidic device according to claim 57 having 1536 target loops.